

問答題 (100%)：請以中文並依題號順序作答

1. Please explain why the two's complement representation is the most commonly used method for representing integers in computers today. What are its characteristics? Please list your explanations in bullet points. (10%)
2. Please sort the following numbers by applying the quick sort algorithm: 55, 77, 22, 66, 11, 44, 88, 33. Please provide a detailed, step-by-step explanation of the sorting process to clearly demonstrate how the algorithm works. (15%)
3. We generally consider UDP a connection-less protocol. Please explain what 'connection-less' means. Additionally, how does UDP determine when to stop transmitting packets? Please explain from the perspective of ICMP (15%)
4. Regarding the TCP protocol in computer networking, please explain the interrelationship between the window in congestion control and the window (also called the sliding window) in flow control. What are the respective functions of these windows, and what is their interrelationship? (15%)
5. When applying the concepts of relational database to data modeling, what are the reasons behind the need for performing 'denormalization'? What are the key implications and effects of this process in terms of database design and performance? Please provide a thorough explanation. (15%)
6. When establishing relational databases, please explain the main reasons why database modelers often establish relationships among entities, or so-called tables. Additionally, if we decide to join two derived tables, do we need to establish relationships between them? Please also explain in detail. (15%)
7. In recent years, the technology and concepts of data storage have continued to evolve, particularly driven by the need for large amounts of data for machine learning and AI-related purposes. Specifically, what is Data Lake, and what is Data Warehouse? Please provide individual definitions and explanations. Additionally, what are the differences between the two? Which one do you think is better? Please explain your thoughts in detail. (15%)